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Indian Standard

SPECIFICATION FOR MILD STEEL AND MEDIUM TENSILE STEEL BARS AND HARD-DRAWN STEEL WIRE FOR CONCRETE REINFORCEMENT

PART I MILD STEEL AND MEDIUM TENSILE STEEL BARS

(*Third Revision*)

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**BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002**

Indian Standard

**SPECIFICATION FOR
MILD STEEL AND MEDIUM TENSILE STEEL
BARS AND HARD-DRAWN STEEL WIRE FOR
CONCRETE REINFORCEMENT**

PART I MILD STEEL AND MEDIUM TENSILE STEEL BARS*(Third Revision)*

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SPECIFICATION FOR MILD STEEL AND MEDIUM TENSILE STEEL BARS AND HARD-DRAWN STEEL WIRE FOR CONCRETE REINFORCEMENT

PART I MILD STEEL AND MEDIUM TENSILE STEEL BARS

(*Third Revision*)

0. FOREWORD

0.1 This Indian Standard (Part I) (Third Revision) was adopted by the Indian Standards Institution on 31 March 1982, after the draft finalized by the Joint Sectional Committee for Concrete Reinforcement had been approved by the Civil Engineering Division Council and the Structural and Metals Division Council.

0.2 This standard was first published in 1953 and subsequently revised in 1960 and 1966. The present revision has been taken up with a view to modifying the earlier provisions in the light of the experience gained during the use of this standard by both manufacturers and users.

0.3 This standard adopts SI units in specifying the various physical requirements. Further, some of the provisions have been revised based on the latest Indian Standards, such as IS : 226-1975*, IS : 961-1975†, IS : 1599-1974‡, IS : 1608-1972§, IS : 1732-1971||, IS : 1762 (Part I)-1974¶ and IS : 1977-1975**.

0.4 The concrete reinforcement having an ultimate tensile strength of not less than 540 N/mm² has been categorized as ' medium tensile steel ' instead of ' high tensile steel ' (see IS : 961-1975†) in this standard. In concrete reinforcement, the term ' high tensile steel ' is, as a general

*Specification for structural steel (standard quality) (*fifth revision*).

†Specification for structural steel (high tensile) (*second revision*).

‡Method for bend test for steel products other than sheet, strip, wire and tube (*first revision*).

§Method for tensile testing of steel products (*first revision*).

||Dimensions for round and square steel bars for structural and general engineering purposes (*first revision*).

¶Code for designation of steel : Part I Based on letter symbols (*first revision*).

**Specification for structural steel (ordinary quality) (*second revision*).

practice, used to mean steel having tensile strengths in a still higher range, say 1 000-2 200 N/mm² which is generally used in prestressed concrete.

0.5 Grade II mild steel bars are not recommended for use in structures located in earthquake zones subjected to severe damage and for structures subjected to dynamic loading (other than wind loading), such as railway and highway bridges (*see* IS : 1893-1975* and IS : 1977-1975†).

0.6 Welding of reinforcement bars covered in this specification shall be done in accordance with the requirements of IS : 2751-1966‡.

0.7 In the formulation of this standard, due weightage has been given to international coordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.8 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960§. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part I) covers the requirements of mild steel and medium tensile steel plain bars in round and square sections for use as reinforcement in concrete.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Bar — A hot-rolled bar of steel of circular or square cross-section.

2.2 Bundle — Two or more ' coils ' or a number of lengths properly bound together.

2.3 Coil — One continuous bar as rolled in the form of a coil.

*Criteria for earthquake resistant design of structures (*third revision*).

†Specification for structural steel (ordinary quality) (*second revision*).

‡Code of practice for welding of mild steel bars used for reinforced concrete construction.

§Rules for rounding off numerical values (*revised*).

2.4 Elongation — Increase in length of a tensile test piece under stress. The elongation at fracture is conventionally expressed as a percentage of the original gauge length of a standard test piece.

2.5 Nominal Size — The nominal size of a bar shall be the dimension of the diameter of round bars and side of square bars.

2.6 Parcel — Any quantity of bars whether in coils or bundles, presented for examination and test at any one time.

2.7 Ultimate Tensile Stress — The maximum load reached in a tensile test divided by the original cross-sectional area of the gauge length portion of the test piece.

2.8 Yield Stress — Stress (that is, load per unit cross-sectional area) at which elongation first occurs in the test piece without increasing the load during tensile test. In the case of steels with no such definite yield point, the yield stress is the stress under the prescribed testing conditions at which the observed increase in the gauge length is 1/200 of the gauge length when the rate at which the load applied is not more than 5 N/mm²/s when approaching the yield stress.

3. TYPES AND GRADES

3.1 Reinforcement supplied in accordance with this standard shall be classified into the following types:

- a) Mild steel bars, and
- b) Medium tensile steel bars.

3.1.1 Mild steel bars shall be supplied in the following two grades:

- a) Mild steel bars, Grade I; and
- b) Mild steel bars, Grade II.

4. MANUFACTURE AND CHEMICAL COMPOSITION

4.1 Steel for mild steel reinforcement bars, Grade I shall be manufactured and have the chemical composition in accordance with the requirements of Steel Designation Fe 410-S of IS : 226-1975*.

4.2 Steel for mild steel reinforcement bars, Grade II shall be manufactured and have the chemical composition in accordance with the requirements of Steel Designation Fe 410-0 of IS : 1977-1975†.

*Specification for structural steel (standard quality) (*fifth revision*).

†Specification for structural steel (ordinary quality) (*second revision*).

4.3 Medium tensile steel bars shall be manufactured and have the chemical composition in accordance with the requirements of Steel Designation Fe 540 W-HT of IS : 961-1975*

5. FREEDOM FROM DEFECTS

5.1 All finished bars shall be well and cleanly rolled to the dimensions and weights specified. They shall be free from cracks, surface flaws, laminations and rough, jagged and imperfect edges and all other harmful defects.

6. NOMINAL SIZES AND MASS

6.1 Sizes — Mild steel and medium tensile steel bars shall be supplied in the following nominal sizes:

Diameter of round bars or side of square bars	5, 6, 8, 10, 12, 16, 20, 22, 25, 28, 32, 36, 40, 45 and 50 mm
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6.2 Mass — The mass of bars shall be in accordance with IS : 1732-1971†.

7. TOLERANCES

7.1 The rolling and cutting tolerances shall be in accordance with IS : 1852-1973‡.

8. PHYSICAL REQUIREMENTS

8.1 The ultimate tensile stress, yield stress and percentage elongation when determined in accordance with 9.2 shall be as given in Table 1.

8.2 The bars shall also withstand the bend test specified in 9.3.

9. TESTS

9.1 Selection and Preparation of Test Samples — Unless otherwise specified in this standard, the requirements of IS : 226-1975§ shall apply.

9.1.1 All test pieces of bars shall be selected by the purchaser or his authorized representative, either:

- a) from the cutting of bars; or

*Specification for structural steel (high tensile) (*second revision*).

†Dimensions for round and square steel bars for structural and general engineering purposes (*first revision*).

‡Specification for rolling and cutting tolerances for hot-rolled steel products (*second revision*).

§Specification for structural steel (standard quality) (*fifth revision*).

TABLE 1 MECHANICAL PROPERTIES OF BARS

(Clause 8.1)

SL No.	TYPE AND NOMINAL SIZE OF BAR	ULTIMATE TENSILE STRESS, <i>Min</i>	YIELD STRESS <i>Min</i>	ELONGATION* PERCENT, <i>Min</i>
1. <i>Mild Steel Grade I</i>				
	For bars up to and including 20 mm	410	250	23
	For bars over 20 mm, up to and including 50 mm	410	240	23
2. <i>Mild Steel Grade II</i>				
	For bars up to and including 20 mm	370	225	23
	For bars over 20 mm, up to and including 50 mm	370	215	23
3. <i>Medium Tensile Steel</i>				
	For bars up to and including 16 mm	540	350	20
	For bars over 16 mm, up to and including 32 mm	540	340	20
	For bars over 32 mm, up to and including 50 mm	510	330	20

*Elongation on a gauge length $5.65 \sqrt{S_0}$ where S_0 is the cross-sectional area of the test piece.

b) if he so desires, from any bar or the coil, after it has been cut to the required or specified length and the test piece taken from any part of it.

9.1.1.1 In neither case, the test piece shall be detached from the bar or the coil, except in the presence of the purchaser or his authorized representative.

9.1.1.2 Before test pieces are selected, the manufacturer or supplier shall furnish the purchaser or his authorized representative with copies of the mill records giving the number of bars in each cast with sizes as well as the identification marks whereby the bars from their cast or each coil can be identified.

9.2 Tensile Test — The ultimate tensile stress, yield stress and elongation of bars shall be determined in accordance with the requirements of IS : 1608-1972* read in conjunction with IS : 226-1975†. The test pieces shall be cut from the finished material and straightened where necessary. They shall not be annealed or otherwise subjected to heat treatment. Any slight straightening which may be required shall be done cold.

9.2.1 In case of bars, the size of which is not uniform throughout the length of test piece, limits shall be applied according to the actual maximum thickness of the piece selected for testing.

9.2.2 Should a tensile test piece break outside the middle half of its gauge length and the percentage elongation obtained is less than that specified, the test may be discarded at the manufacturer's option, and another test made from the same bar.

9.3 Bend Test — The bend test shall be performed in accordance with the requirements of IS : 1599-1974‡ read in conjunction with IS : 226-1975†.

9.4 Retest — Should any one of the test pieces first selected fail to pass any of the tests specified in this standard, two further samples shall be selected for testing in respect of each failure. Should the test pieces from both these additional samples pass, the material represented by the test samples shall be deemed to comply with the requirements of that particular test. Should the test piece from either of these additional samples fail, the material represented by the test samples shall be considered as not having complied with this standard.

9.5 Sampling — Sampling for tensile and bend tests shall be in accordance with IS : 226-1975†.

10. DELIVERY, INSPECTION AND TESTING FACILITIES

10.1 Unless otherwise specified, general requirements relating to the supply of material, inspection and testing shall conform to IS : 1387-1967§.

10.2 No material shall be despatched from the manufacturer's or suppliers' premises prior to its being certified by the purchaser or his authorized representative as having fulfilled the tests and requirements laid down in this standard except where the bundle or coil containing the bars is marked with the ISI Certification Mark.

*Method for tensile testing of steel products (*first revision*).

†Specification for structural steel (standard quality) (*fifth revision*).

‡Method for bend test for steel products other than sheet, strip, wire and tube (*first revision*).

§General requirements for the supply of metallurgical materials (*first revision*).

10.3 The purchaser or his authorized representative shall be at liberty to inspect and verify the steel maker's certificate of cast analysis at the premises of the manufacturer or supplier; when the purchaser requires an actual analysis of finished material, this shall be made at a place agreed to between the purchaser and the manufacturer or supplier.

10.4 Manufacturer's Certificate — In the case of bars which have not been inspected at the manufacturer's works, the manufacturer or supplier, as the case may be, shall supply the purchaser or his authorized representative with the certificate stating the process of manufacture and also the test sheet signed by the manufacturer giving the result of each mechanical test applicable to the material purchased, and the chemical composition, if required. Each test sheet shall indicate the number or identification mark of the cast to which it applies, corresponding to the number or identification mark to be found on the material.

11. IDENTIFICATION AND MARKING

11.1 The manufacturer or supplier shall have ingots, billets and bars or bundles of bars marked in such a way that all finished bars can be traced to the cast from which they were made. Every facility shall be given to the purchaser or his authorized representative for tracing the bars to the cast from which they were made.

11.2 The medium tensile steel bars shall be suitably marked to identify them from mild steel bars. Mild steel bars Grade I and II shall have distinctive identification tags.

11.3 Each bundle or coil containing the bars may also be suitably marked with the Standard Mark, in which case the concerned test certificate shall also bear the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1936 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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